

## Claims

1. A method of representing road-related information characterized by representing road-related information together with gray scale information for displaying attributes of said road-related information in multiple levels.

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2. The method of representing road-related information according to claim 1, characterized in that said road-related information is traffic information and the traffic information is represented by a state volume of traffic information and gray scale information for displaying the attributes of said state volume in multiple levels.

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3. The method of representing road-related information according to claim 2, characterized by displaying reliability of the state volume of said traffic information in multiple levels by using said gray scale information.

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4. The method of representing road-related information according to claim 3, characterized by representing the state volume of said traffic information by state volume at each of sampling points set by segmenting a target road and representing the reliability of said state volume by a numeric value of said gray scale information associated with each of said sampling points.

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5. The method of representing road-related information according to claim 3 or 4, characterized by displaying a line according to the state volume of said traffic information on a map and changing transmittance of said line depending on the reliability represented by said gray scale information.

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6. The method of representing road-related information according to claim 3 or 4, characterized by displaying a line according to the state volume of said traffic information on a map and changing a thickness of said line depending on the reliability represented by said gray scale information.

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7. The method of representing road-related information according to claim 3 or 4, characterized by displaying a line according to the state volume of said traffic information on a map and changing a line type of said line depending on the reliability represented by said gray scale information.

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8. The method of representing road-related information according to

claim 3 or 4, characterized by setting the reliability represented by said gray scale information by using installation density of sensors which collect the state volume of said traffic information.

5     9.     The method of representing road-related information according to claim 3 or 4, characterized by setting the reliability represented by said gray scale information by using detection accuracy of sensors which collect the state volume of said traffic information.

10    10.    The method of representing road-related information according to claim 3 or 4, characterized by setting the reliability represented by said gray scale information by using a time which has elapsed since the state volume of said traffic information was collected.

15    11.    The method of representing road-related information according to claim 3 or 4, characterized by setting the reliability represented by said gray scale information by using the chronological variations in the state volume of said traffic information.

20    12.    The method of representing road-related information according to claim 3 or 4, characterized by setting the reliability represented by said gray scale information by using variations in the state volume of said traffic information in a predetermined period.

25    13.    The method of representing road-related information according to claim 3 or 4, characterized by setting the reliability represented by said gray scale information by using a difference between the state volume of said traffic information obtained based on information from a sensor installed at a road and said state volume obtained based on information from a probe car.

30    14.    The method of representing road-related information according to claim 3 or 4, characterized by setting the reliability represented by said gray scale information by way of accuracy of a calculation system used to estimate the state volume of said traffic information.

35    15.    The method of representing road-related information according to claim 3 or 4, characterized by setting the reliability represented by said gray scale information by way of variations in an estimation result of the state

volume of said traffic information.

16. The method of representing road-related information according to claim 3 or 4, characterized by setting the reliability represented by said gray scale information by way of a percentage of correct answers in the estimation record of the state volume of said traffic information.

17. The method of representing road-related information according to claim 3 or 4, characterized by setting the reliability represented by said gray scale information by way of number of samples of probe car information used to determine the state volume of said traffic information.

18. The method of representing road-related information according to claim 2, characterized by displaying a difference of the state volume of said traffic information from normal traffic in multiple levels by using said gray scale information.

19. The method of representing road-related information according to claim 18, characterized by obtaining said difference by comparing the state volume of newly measured traffic information with a statistical value of the state volume of said traffic information measured in plural occasions in the past.

20. The method of representing road-related information according to claim 19, characterized by using the state volume of past traffic information in which a day type of a measurement day is common, as a reference used for comparison of the state volume of said newly measured traffic information.

21. The method of representing road-related information according to claim 19, characterized by using the state volume of past traffic information in which weather of a measurement day is the same, as a reference used for comparison of the state volume of said newly measured traffic information.

22. The method of representing road-related information according to claim 2, characterized by displaying variations in the state volume of said traffic information in multiple levels.

23. The method of representing road-related information according to

claim 1, characterized in that said road-related information is path information and said path information is represented by said path information and the gray scale information for displaying the attributes of said path information in multiple levels.

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24. The method of representing road-related information according to claim 23, characterized by displaying the superiority of a shortest-travel-time path over the other paths by way of said gray scale information.

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25. The method of representing road-related information according to claim 24, characterized by using a shortest-distance path as a reference path of said superiority.

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26. The method of representing road-related information according to claim 24, characterized by using a pre-registered path as a reference path of said superiority.

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27. The method of representing road-related information according to claim 24, characterized by segmenting said shortest-travel-time path into a plurality of sections and respectively obtaining the superiority of the shortest-travel-time path in each section over a reference path set in each section.

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28. The method of representing road-related information according to claim 24, characterized by setting a reference path between a beginning and an end of said shortest-travel-time path to set, to maximum, said superiority of a section where said shortest-travel-time path and the reference path match each other, thereby obtaining the superiority of a section where said shortest-travel-time path and the reference path differ from each other.

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29. Terminal apparatus comprising: reception means for receiving gray scale information which displays a state volume of traffic information and attributes of said state volume in multiple levels; and display means for displaying the state volume of said traffic information in a form corresponding to the value of said gray scale information.

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30. The terminal apparatus according to claim 29, characterized by comprising transmission means for transmitting information which indicates a

reference of said state volume to a center which provides said traffic information and gray scale information.

31. Terminal apparatus characterized by comprising: transmission means for transmitting information on a current position and a destination; reception means for receiving gray scale information for displaying path information and superiority of said path information in multiple levels; and display means for displaying said path information in a form corresponding to the value of said gray scale information.

32. Terminal apparatus characterized by comprising: reception means for receiving traffic information; route calculation means for calculating a shortest-travel-time path from a current position to a destination by referencing said traffic information; attribute information calculation means for displaying superiority of said shortest-travel-time path in multiple levels; and display means for displaying said shortest-travel-time path in a form corresponding to the value of said gray scale information.

33. Path information calculation apparatus comprising:  
dynamic link cost calculation means for calculating a dynamic link cost of a link based on a state volume of traffic information;  
static link cost provision means for providing a static link cost of said link; and  
link cost determination means for changing a distribution ratio of the dynamic link cost and static link cost based on a gray scale information which represents reliability of superiority of traffic information in multiple levels in order to generate a link cost used for path calculation.

34. A traffic information providing system comprising: traffic information providing apparatus for retaining, as traffic information, a state volume of traffic information and gray scale information for displaying the reliability of said state volume in multiple levels and providing traffic information to which said gray scale information is appended; and client apparatus for receiving said traffic information from said traffic information providing apparatus; characterized in that said traffic information providing apparatus sets a value of traffic information to be provided to said client apparatus in accordance with said gray scale information appended to said traffic information.

35. A traffic information providing system comprising: traffic information providing apparatus for providing, as traffic information, a state volume of traffic information at each of the sampling points set by segmenting a target road and mask bit information indicating that said state volume is valid or  
5 invalid; and traffic information utilization apparatus for receiving said traffic information and reproducing said valid state volume by using said mask bit information.

36. The traffic information providing system according to claim 35,  
10 characterized in that said traffic information providing apparatus provides information which represents, as said mask bit information, said valid state volume by 1 and said invalid state volume by 0 and that said traffic information utilization apparatus obtains a logical product of said state volume provided by  
15 said traffic information providing apparatus and said mask bit information corresponding to the state volume and reproduces a valid state volume.

37. The traffic information providing system according to claim 35,  
characterized in that said traffic information providing apparatus provides, as  
20 said traffic information, data representing an array of said state volumes and data representing an array of said mask bit information.

38. The traffic information providing system according to claim 37,  
characterized in that said traffic information providing apparatus quantizes the  
25 data representing an array of said state volumes, converts the obtained value into a value statistically deviated, variable-length encodes the obtained value and provides the encoded value, and encodes the data representing the array of said mask bit information and provides the encoded data.

39. The traffic information providing system according to claim 37,  
30 characterized in that said traffic information providing apparatus converts the data representing the array of said state volumes to a coefficient of frequency component, quantizes said coefficient, variable-length encodes the obtained value and provides the encoded value, and encodes the data representing an  
35 array of said mask bit information and provides the encoded data.

40. The traffic information providing system according to claim 35,  
characterized in that said traffic information providing apparatus sets said state  
volume at a sampling point where said state volume is invalid to a value

approximate to a valid state volume of an adjacent sampling point.

5 41. The traffic information providing system according to claim 40, characterized in that, when said state volumes of a plurality of sampling points constituting continuous sections are all invalid, said traffic information providing apparatus sets the state volume at each of said plurality of sampling points to a value which continuously changes from a valid state volume at a sampling point adjacent to the beginning of said continuous sections to a valid state volume at a sampling point adjacent to the end of said continuous sections.

10 42. The traffic information providing system according to claim 40, characterized in that, when said state volumes of a plurality of sampling points constituting continuous sections are all invalid, said traffic information providing apparatus sets the state volume of a sampling point from the beginning to the center of said continuous sections to a same value as a valid state volume at a sampling point adjacent to the beginning of said continuous sections and sets the state volume of a sampling point from the center to the end of said continuous sections to a same value as a valid state volume at a sampling point adjacent to the end of said continuous sections.

20 43. The traffic information providing system according to claim 40, characterized in that, when said state volumes of a plurality of sampling points constituting continuous sections are all invalid, said traffic information providing apparatus sets the state volume of a sampling point from the beginning to the center of said continuous sections to a value obtained through functional approximation using valid state volume of a plurality of sampling points beyond the beginning of said continuous sections and sets the state volume of a sampling point from the center to the end of said continuous sections to a value obtained through functional approximation using valid state volume of a plurality of sampling points beyond the end of said continuous sections.

25 44. The traffic information providing system according to any of claim 35 through 43, characterized in that said traffic information providing apparatus provides said traffic information as well as road section reference data to identify said target road and that said traffic information utilization apparatus identifies said target road from said road section reference data.

30 45. Traffic information providing system used in the traffic information

providing system according to any of claims 35 through 44, characterized by comprising: a traffic information converter for converting a state volume of traffic information changing along a road to an array of values of sampling points set by segmenting a target road as well as generating an array of mask bit information indicating that said values are valid or invalid; an encoder for encoding data generated by said traffic information converted from said state volume of traffic information and data of said mask bit information; and an information transmitter for transmitting the data encoded by said encoder.

46. Traffic information utilization system used in the traffic information providing system according to any of claims 35 through 44, characterized by comprising: an information receiver for receiving, from traffic information providing apparatus, encoded data concerning the state volume of traffic information on a target road, encoded data of mask bit information indicating that said state volume values are valid or invalid, and road section reference data to identify said target road; a decoder for decoding each item of said encoded data and reproducing a valid state volume from said state volume of traffic information and said mask bit information; and a determination section for performing map matching by using said road section reference data and identifying the target road of said traffic information.

47. A traffic information display method characterized by segmenting a target road of traffic information to set sampling points, setting 1 of mask bit information in association with said sampling point where a valid state volume of traffic information is obtained, setting 0 of mask bit information in association with said sampling point where a valid state volume of traffic information is not obtained, and presenting an array of said mask bit information together with an array of state volumes of said sampling points.